

Accelerator Systems Division Highlights for the Week Ending April 20, 2001

ASD/LBNL: Front End Systems

SNS FRONT END HAS OBTAINED FIRST RF-ACCELERATED BEAM! Late on Friday afternoon, April 20, the first beam was injected from the LEBT and transported through RFQ Module 1. Verification tests showed that the beam is positioned well on axis and is transported through the cavity only when the RF power is near its nominal value. The transported current was 38 mA peak and 32 mA pulse average, well in line with approximately 36 mA pulse average injected.

Prior to this breakthrough event, RFQ Module 1 had been connected to the LEBT vacuum tank in a speedy operation and was conditioned to the nominal RF power amplitude of 155 kW, so far with short duty factor.

Performing RFQ beam experiments much earlier than originally planned was possible due to the recently achieved, consistently good performance of Ion Source #1 and LEBT.

RFQ Module 2 is right on frequency after the final braze. The cavity is now being made ready for RF conditioning.

RFQ Module 3 (in dry assembly) is right on frequency and being made ready for the final braze.

The MEBT Rebuncher Cavity 1 is ready for copper plating after adjusting its resonant frequency.

A town meeting with SNS director Thom Mason was held at LBNL on 4/18.

ASD/LANL: Warm Linac

LANL and ASD conducted a systems requirements review for the SRF transmitters at the vendor's facility. (WBS 1.4.1.1)

JLAB visitors arrived at LANL this week with their KEK prototype couplers. After site-specific training, our visitors and their LANL hosts started preparing for the high-power RF test. (WBS 1.4.1)

Our LLRF team assessed the impact of recent changes by CF in the FELK chases and room temperature specification. Either the linac phase error requirement will need to be slightly relaxed or additional scope needs to be formally added to control chase and/or LLRF cable temperature variations. LANL will prepare menu of options for ASD. (WBS 1.4.1.3)

LANL submitted comments to CF and ASD on impact of the recent decision to lower the height of the klystron-building ceiling.

We replaced beryllium with graphite in the design of the energy degrader for the diagnostic plate. Although the mechanical and heat-transfer properties are not as favorable with graphite, we are exploring machining and mounting techniques that will allow use of the degrader at reduced duty factor. (WBS 1.4.5.2)

We are well into the production of the DTL PMQ's (Fig. 1) and have authorized the vendor to begin shipment to LANL. Aster has all the magnet pieces in house to fabricate our 160 PMQ's plus a few extras; they have completed about 50 PMQ assemblies that are ready to be vacuum cleaned. Integrated Machine Inc. has shipped the 40 additional housings. (WBS 1.4.2.3)

LANL's Budget at Completion was reduced by approximately \$1M, a result of returning \$1.5M to contingency of unnecessary escalation budget (primarily from locked-in prices in recent RF procurement awards), and receiving \$0.5M from contingency in the implementation of PCRs in March. Details are reported in our March status report. (WBS 1.4.6.1)



Fig. 1: The first production DTL permanent magnet quadrupoles for SNS

In response to a request from ASD, we have delayed the DTL FDR by one week. It is now scheduled for May 8-9. (WBS 1.4.2.)

Manufacturing of the CCL hot model continues. End walls and stacked cells are being shipped to the brazing shop, while machining of the power bridge coupler (Fig. 2) is well underway. (WBS 1.1.2.2)

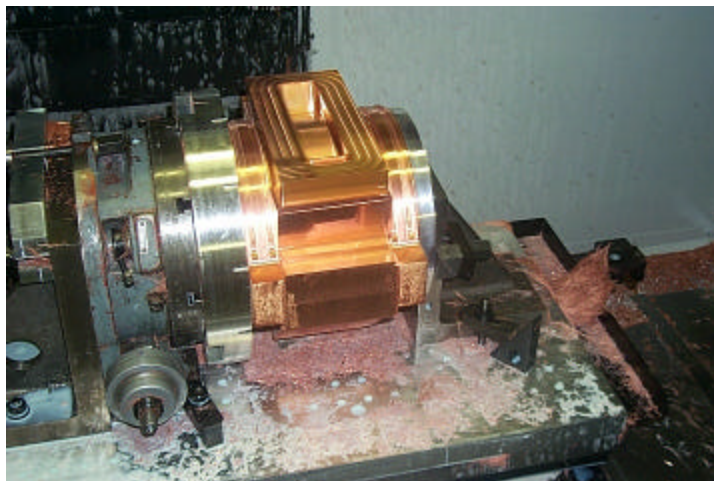


Fig. 2: Powered bridge coupler for the CCL hot model

PCRs LI 01 012 (FY00 Replanning Cost Impact) and LI 01 020 (Travel/Relocation Costs for Magnet Engineer) were accepted this week. They will be implemented before the May DOE review. (WBS 1.4.6.1)

K. Boudwin, S. Herron, and J. Hill visited LANL this week to discuss the Foyt audit, and the SNS Equipment Reliability Availability and Maintainability System (ERAMS). They also observed our monthly status meeting with our WBS managers. (WBS 1.4.6.1)

ASD/JLAB Cold Linac

Fabrication on the Warm Compressors, Cold Compressors, and 4.5K Coldbox continues. The Cold Compressor procurement FDRR (3rd review) was held on 18 & 19-Apr. The FDR (4th review) will be held on 26 & 27-June.

The first set of four tunnel female bayonet / valve assemblies are 90% complete. The other 31 sets are in various stages of welding and brazing.

Ten additional HOM's have been e-beam welded.

The final machining of the MB dumbbells for cavities #2-4 is nearing completion.

The first pair of fundamental power couplers has been shipped to LANL; the JLab crew is at LANL helping to set up for a test run next week.

Activities continue for the three high beta HOM modes considered dangerous for power generation if not sufficiently damped. Two harmonic modes have been found. The final 7th harmonic mode does not propagate into the beam tube and must be damped. This is the mode that could produce 473w of power with a $Q=10^8$ (see Sundelin's ASAC talk). It has been found in the cold cavity but not warm.

The Electro-Polish parts bid is due next week. Work on the specification for the EP cabinet continues.

The Vacuum Tank bids are being evaluated. Reactor grade Nb bids are due back by 23-Apr. Cavity ends bids are due back by 30-Apr. The Cavities prebid meeting was held on 18-Apr; bids are due 16-May.

The three PCR's for R&D to improve the HB performance from 27.5 to 35.0 MV/m. are waiting for approval (LI 01-016, 17 & 18)

There is only one remaining \$250K procurement to release this year. We could productively use an additional \$1-2M of BA if it became available.

The LANL 1MW RF system plan for JLab testing needs to be approved (LANL LI 01-035 & JLab LI 00-068). In the fall of 1999 as part of the MOU discussion, it was agreed that SNS would provide a skidded RF system for the JLab testing of CM's and power couplers. It is needed in the 2nd Q FY02 to test the Prototype CM at full power. If the PCR is approved now, the best LANL can do is deliver a system after we start full 1 CM per month production. (Depending on interpretation, this is also a 6-month slip in the Milestones #1b-3 and 2-30.) The ASAC last year raised this as one of the highest priorities. This system is a key element not only for conditioning and acceptance testing but also is the key to raising the High Beta Gradient from 27.5 to 35.0 MV/m. The immediate approval of these PCR's is required to get started working on this. LANL requires a minimum funding of 20% of LI 01-035 to get started planning, and JLab requires a minimum funding of 25% of LI 00-068 in order to procure long lead items (vacuum circuit breakers, heat exchangers, pumps, pipe, and valves). We want to have the system installed and checked out when the Klystron arrives.

The CHL BOD has slipped 8 months; it is now after the last of the refrigeration equipment has been delivered. The installation, commissioning, and burn in schedule has been compressed by 4 months to recover half of this slip, but the sub-system acceptance test deadlines and most of the warranties will have expired. The A&E has supplied an RFE date 6weeks before BOD, which matches the delivery date of the 4.5 K Coldbox. Discussions are continuing.

ASD/BNL Ring

An RFQ has been released to BNL's Contracts Dept. for the procurement of the 26Q40 Ring quadrupoles. This order will be phased funded over two years.

Systems Integration - DCDs for Ring Vacuum Systems and RF System are being finalized for submittal to DCC.

Systems Integration - Kathy Brown and Bill Fritz participated in the iMAN videoconference where a 6/01/01 date for electronic file implementation transition has been proposed.

The BNL issues related to beam dumps, drift tubes and convention construction are being prepared for the upcoming videoconference workshop scheduled for 4/24/01.

BNL Engineering and QA returned from their visit to Danfysik where procurements for the Low Field Power Supplies and the 27CDM 30 Ring corrector magnets were addressed.

A procurement contract was issued to Danfysik to build thirty-two 12Q45/Corrector magnet assemblies for the HEBT beam line. Deliveries will be direct to SNS/OR. This contract will be phased funded over two years.

T. Nehring submitted BNL's comments on 75% CF Review to J. Stellern.

Comments on Ring Conventional SRD, Rev. 2, were submitted to J. Stellern.

Bill Birkholz completed a one-day trip to Ohio where he visited with all three vendors responsible for the first phase of Ring dipole steel fabrication. He witnessed vendor efforts that included flame cutting, heat-treating, and final grinding. The first lot of steel is now on its way Allied Engineering for final machining. See photo below of a typical rough machined pole piece with machined "z" bumps.



Fig. #1 – Ring Arc Dipole Pole Piece with Machined "Z" Bumps

Controls:

A draft plan for handover (to SNS/ORNL) of linac control systems was prepared. This will be further developed in consultation with the controls team at LANL. Similar plans will be developed for the front End and Ring controls.

The final shipment of Group 3 units for the MEBT was received at LBNL.

The Front End DTI -65kV supply Group 3 interface was completed and tested in modular format

SNS/ORNL engineers responsible for the Personnel Protection System and Cryo Control Systems attended Allen-Bradley ControlLogix training. Both systems will make extensive use of these programmable logic controllers. The

training on the use of ControlNet for communication between components was timely as detailed design of ControlNet communication for these systems is starting.

We are looking at the implications for the MPS and diagnostics from damage caused by beam loss in the DTL. A LANL report states that surface damage to copper in the DTL can occur in as little as 4 us.

Locations have been determined for network switch cabinets in the Target building to serve Target Systems control. Suggested locations were sent to the AE for inclusion in the next drawing updates. These switch cabinets will also be used to serve Conventional Facilities and the neutron instruments.

A draft Conventional Facilities Controls Interface Control Document (ICD) has been completed and is being reviewed. This document defines functional, contractual, and physical interfaces between CF controls electronics and software to CF mechanical, power, and other systems and their equipment suppliers.

A note was generated on archiving files on Linux systems using compact disks. This turns out to be not as straightforward as anticipated.

Last week the Linux cluster at BNL was upgraded with the RedHat 7.0 version of Linux and all the parallel-related software was reinstalled and tested. The prime reason for doing this was to have BNL running the same version of the software as ORNL.

Ernest Williams visited BNL, and is looking into moving standard EPICS software from ORNL to BNL. Differences in the operating systems, environment and software versions prevented easy porting of some software between sites. Ernest will continue work with BNL until the fully standard environment is in use at all sites.

BNL ordered an extra node for the cluster so that one node could be dedicated to Epics.

The prototype of the UAL Application Manager has been installed on the BNL and ORNL computers. The Application Manager is the first module of the UAL 2.0 application toolkit. It aims to provide the Windows Explorer-like navigation interface to diverse UAL 2.0 toolkit applications.

ASD/ORNL: Integration

Accelerator Physics

Operations

The Draft ASD Beam Loss Policy is on the SNS web site at http://www.sns.gov/projectinfo/operations/envelopes/loss_policy.pdf. All are invited to comment on this draft report.

Commissioning Teams have been established for the Front End and the Linac. Meetings of these groups will be on alternating Thursdays at 4:00 eastern. The meetings will start with a Front End Commissioning Team meeting, Thursday April 26. All interested parties are invited to attend.

An Operations Deputy candidate and an Accelerator Chief Operator Candidate were interviewed.

Work was done on the schedule of beam power delivery for the low power operations period that will follow CD4. This plan was discussed at a meeting with representatives of the XFD.

Installation and RATS Building

Magnet Measurement Group

Ion Source Group

Materials and processing techniques for improved antenna coatings have been finalized. We expect coating densities close to 100% by using the HVOF (high velocity oxy fuel) technique, where particles impact with velocities in excess of Mach 4. Thermal Spray Technologies is prepared to HVOF coat some antennas with Al₂O₃, some with Cr₂O₃, and the rest with a composite of the two as soon as they receive the bare copper antennas supplied by LBNL.

To reduce the electron current escaping the SNS ion source, it has been proposed to reduce the aperture of the electron dump from 8.4 to 5.0 mm. Initial model calculations for a 40 mA extracted H⁻ ion beam indicate a ion beam loss of roughly 10%. More detailed calculations are planned.

Requisitions for most of the custom electronics hardware for the Hot Spare Stand have been initiated.

Martin Stockli used a 3-day LBNL visit to transfer technology for the hot spare stand, to get acquainted with the internal alignment process, and to coordinate other common efforts.

RF Group

Cryo Transfer Line Group

The supers insulating winding and cutting tables are completed and operational.

We have passed the EPA tests for Oak Ridge and the state of Tennessee for dumping out pipe cleaning liquids down the sewer system.

We are installing the final assembly tooling onto the development tables we borrowed from Jefferson lab.

We are still targeting the 7th of May as the day we will be in complete development.

Mechanical Group

To clarify the shielding space requirements in the FE building (around DTL tanks 1 and 2), a transmittal has been generated and is in the signature loop. It will be given to CF next week. The transmittal specifies (1) keep clear areas that are reserved for future shielding, (2) that the wall south of DTL tanks 1 and 2 be solid concrete block (not block with voids), and (3) that a hole through the floor of the mezzanine be moved north to reduce the resulting radiation leak. These changes are expected to have minimal impact on the CF design.

The chase definition spread sheet has been updated (to revision 7) to change the elevation of the 24" chases for the medium beta modules. The centers of these chases are now at the same elevation as the adjacent 30" chases. This change was required to allow the MB waveguides to be routed directly to the couplers on the module without additional bends. This change has been incorporated into the AE design package.

Power Supply Group

Survey and Alignment Group

Beam Diagnostics Group

BPMs: At LANL: FPGA testing continues to look good. A new PCI card design is required, but LANL ECAD resources are presently unavailable so we will seek an ECAD firm outside LANL. We hope to order the DFE PC card early next week. The DTL pickups are now being machined by a vendor in ABQ. At BNL: Shop has completed the rework of the strip-lines of the two 21cm HEBT BPMs. Delivery to us is expected after cleaning and inspection. Parts for the two 12cm HEBT BPMs are almost completed. An ECN is in preparation to update the design drawings of the 21 cm Ring BPM to the newly built unit. Reviewed the quantities required in the Ring, HEBT (37 instead of 22), and RTBT. Continued work on solution to mounting the 30cm Ring BPM onto the pole tips of the narrow 30cm quad. Investigating Beam based alignment issues.

D-plate: At LANL: The search continues for pre-owned equipment and designs to use on the D-plate. The IPF x-y steering magnet design looks like a winner. The IPF BPM pickups have LAMPF standard flanges, so the design would have to be modified. The electrodes also would produce 6 dB less power, and since they have vacuum feed throughs on the downstream end, the electrical response could be compromised. Investigations continue. The D-plate emittance collectors will likely be larger than usual (about 8 cm), so it is unlikely we can just clone an existing design. We are considering making the collector from a printed circuit card with suitably thick cladding to simplify construction.

Energy degraders and Faraday Cups: At LANL: Use of a graphite energy degrader for the D-plate continues to look promising. To reduce the costs, for all installation locations we plan to mount the energy degraders and Faraday Cups on a single actuator. There will be a bias ring between the two devices, which will allow the Faraday Cup and energy degrader signals to be dc coupled to the amplifiers.

Actuators: The Bimba and Huntington actuators orders have not yet left LANL due to delays in the procurement office.

IPM: At BNL: Parts for two Electron detectors have been ordered through BNL shops and an outside vendor. Electron density measurements were made during AGS Booster cycle.

BLM: Testing continues with BLM response to the fast proton beam transported to the G-2 target. Investigating X-Ray effects on BLM's. Scheduled a meeting first week in May at LANL to discuss Linac BLM issues. To warm up, Saeed is scheduling a videoconference on loss monitor issues.

BCM: Made some schematic revisions for layout purposes, layout has been given components to assure proper pad patterns are used. Started to look into providing a differential measurement of the first microsecond of the macro-pulse to support LANL need for a fast Machine Protect System shutdown for the first tank. Work continues on the gain control digital design, and interface with the LANL motherboard. Setting-up a laboratory to do digital interface investigations.

Tune: BNL continued progress with PLL tune prototype

Carbon Wire Scanner: At BNL: new ME on-board, familiarizing himself with the system, reviewing calculations, concepts, and design. Central shop given initial sketches for MEBT wire scanner fork and connection parts for material preparation. Investigating the attachment of the carbon fibers to the wire scanner fork, commonality w/ LANL.

Laser Wire Scanner: At BNL: received second laser (50mJ unit to be used for MEBT), detailed design will begin next week. Working with LANL to assure software compatibility between wire scanners and laser scanner. Preparations were made for a laser wire presentation to the BNL AP group meeting.

General: Dave Purcell developed a web interface to diagnostics data in Oracle. Most linac diagnostics have been named and information on ring diagnostics has been received from BNL. A rack mount PC and a StrongArm-based embedded system have been received. We will now proceed with integration testing. LBL received 9 timing interface boards. Saeed continues testing Matlab as an application platform. Tom, Dave Gurd, and John Galambos met to discuss application architecture, middleware, and data collection. A follow-up meeting was held to discuss a specific application example: the difference orbit app. Tom worked with ORNL and LANL personnel to refine the warm section design. The transition plan for LANL diagnostics is being finalized with significant help from Bob Hardekopf. The parameter list was reviewed in collaboration with AP. Preparations have begun for Diagnostics presentation at DOE Review.